ASEC 2025 Conference

The 6th International Electronic Conference on Applied Sciences

09–11 December 2025 | Online

MDPI

An Automated Medical Diagnosis System for Neoplasm Medical (MRI) Image Classification using Supervised and Unsupervised Techniques

Sreedhar Kumar Seetharaman [1*,3], and Thouheed Ahmed Syed[2]

***1 Department of Information Science and Engineering, Sir M Visvesvaraya Institute of Technology, Bengaluru, Karnataka, India**

2 School of Computer Science and Engineering, REVA University, Bengaluru, Karnataka, India

3 Post Doctoral Researcher, Lincoln University College, Malaysia

INTRODUCTION & AIM

An improved automated medical prediction system namely Neoplasm Medical (MRI) Image Classification System (NMICS) and it aimed to robotically identify the test medical (MRI) image which is grouped into the neoplasm (Tumor) or non-neoplasm (non-tumor) group, respectively using machine learning techniques. The proposed (NMICS) system is divided into two stages, namely, the Train Medical (MRI) Image Model (TMIM) and Medical Image Predication Stage (MIPS), respectively. In the TMIM stage, the NMICS system is performing various distinct operations including 1) improving input medical (MRI) image data set quality and consistency through standard arithmetic operations, 2) extracting the specific features (edge) from every individual medical image in the input MRI image data set using standard edge detection approach and 3) separating the feature vector set of the input MRI image data set into two distinct clusters, namely, Tumor and Non-Tumor, respectively, using the unsupervised k-means clustering technique. In the MIPS stage, the NMICS system is performing the same types of operations over the test medical image samples, which are followed in the TMIM stage excluding training operation. Next, the NMICS system maps and classifies the feature vector of the test medical image sample with trained medical image data set clusters using a KNN classifier

METHOD

The Proposed NMICS system is designed to partition brain MRI images into two clusters through the dynamic identification of centroids using the K-means clustering algorithm. Additionally, it performs the classification of brain MRIs into tumor and non-tumor categories. This process involves multiple stages, including image preprocessing, edge feature extraction, clustering, and classification. The functional stages of the RCS-BMIC are visually depicted in Figure 1.

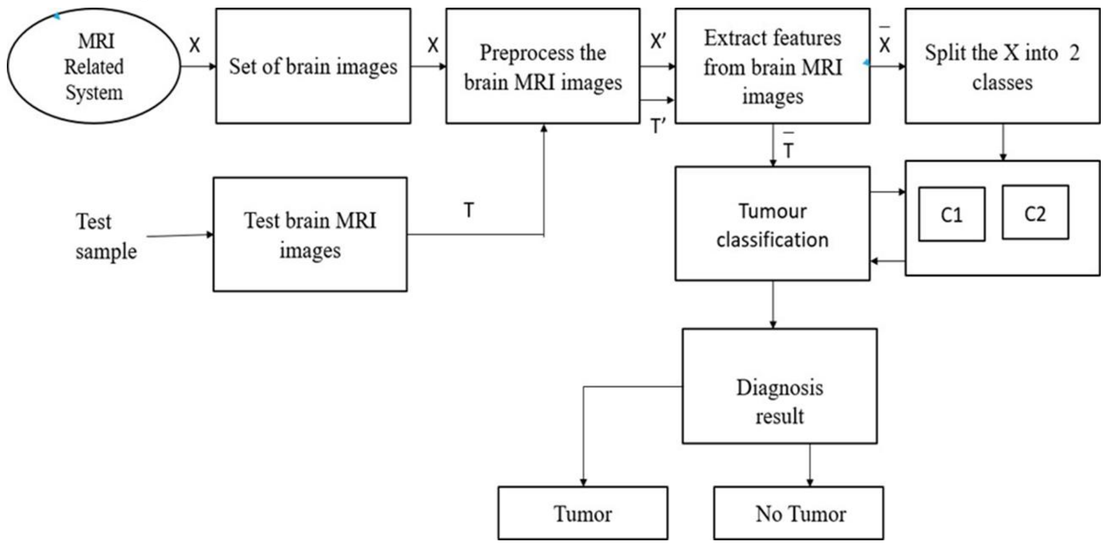


Figure 1: Proposed NMICS System Architecture

MRI Image Collection:

A set of brain MRI images deployed in an RCS-BMIC system, represented as $\boldsymbol{X}=\boldsymbol{X\_i}$ for, $\boldsymbol{X\_i}=\boldsymbol{X\_ijr}$, $\boldsymbol{i}=\mathbf{1},\mathbf{2},..,n$ $\boldsymbol{j}=\mathbf{1},\mathbf{2},..,\boldsymbol{h}$, $\boldsymbol{r}=\mathbf{1},\mathbf{2},..,w$ where $\boldsymbol{X\_i}$ indicates the $\boldsymbol{i\text{^}th}$ input medical image in the MRI image deposit $\boldsymbol{X}$ with n MRI image, $\boldsymbol{X\_ijr}$ is denoting that pixel element location of $\boldsymbol{j\text{^}th}$ row and $\boldsymbol{r\text{^}th}$ Column in the $\boldsymbol{i\text{^}th}$ MRI image in input medical, $\boldsymbol{n}$ is the size of the input medical image set $\boldsymbol{X}=\boldsymbol{X\_i}$, $\boldsymbol{w}$ is describing the width of image and $\boldsymbol{h}$ denotes the height of the input medical image In the input image repository .

MRI Image Pre-Processing:

Gaussian blur is a common technique employed in preprocessing brain MRI images to reduce noise and enhance the clarity of structural information. Mathematically, the Gaussian blur operation involves convolving the image with a Gaussian kernel. The convolution of an image with a 2D Gaussian kernel is given by

Feature Extraction:

In this stage, the proposed system is currently focused on extracting edge features from brain MRI images with the goal of identifying unique patterns that distinguish tumor regions from non-tumor areas using convolution neural network. In brain tumor detection using Convolutional Neural Networks (CNNs). In this context, the CNN layers identify distinctive patterns or structures in MRI images that are indicative of tumors.

Training Stage:

In this stage, the proposed system is split the brain MRI image set into two clusters such as (tumor) and (no tumor) using k-means algorithm after the CNN feature extraction and pooling

Classification Stage:

Classification of brain MRI images as tumor and no tumor typically involves using machine learning algorithms. In this context, C1 (Normal) and C2 (Tumor) clusters likely refer to distinct features or patterns associated with the classes. The algorithm analyzes patterns in the MRI images, using features from C1 (tumor) and C2 (no tumor) clusters to distinguish between tumor and non-tumor cases. This process aids in accurate classification based on the identified patterns in the images.

RESULTS & DISCUSSION

The historical brain MRI images are collected from the medical related system as a image dataset. A total of 253 images were collected from a Kaggle platform with different size including count of 155 tumor images and 98 no tumors images respectively. For the demonstration purpose, we have randomly selected few number of images from the image data set and the sample medical pictures are presented in the Figure.2.

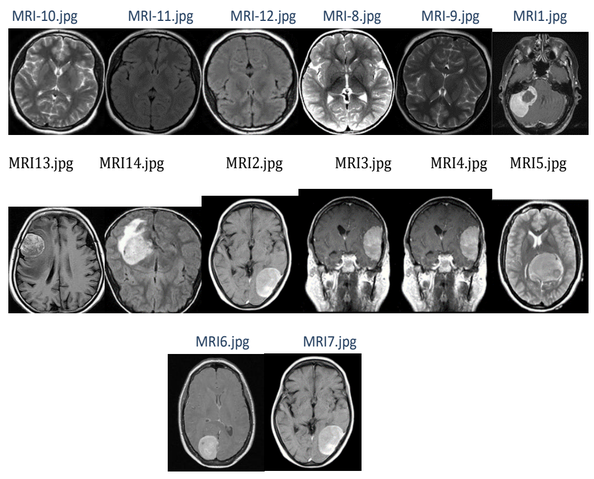


Figure 2: Input MRI Image Samples with Different Size

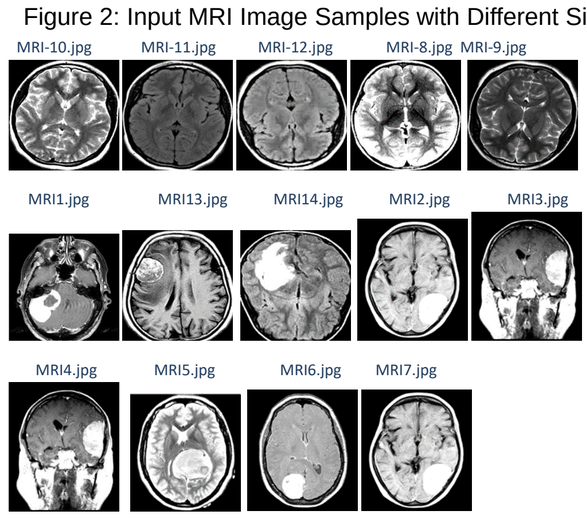


Figure 3: Result of Pre-Processed Stage Over the Input MRI Image Samples in Figure 2

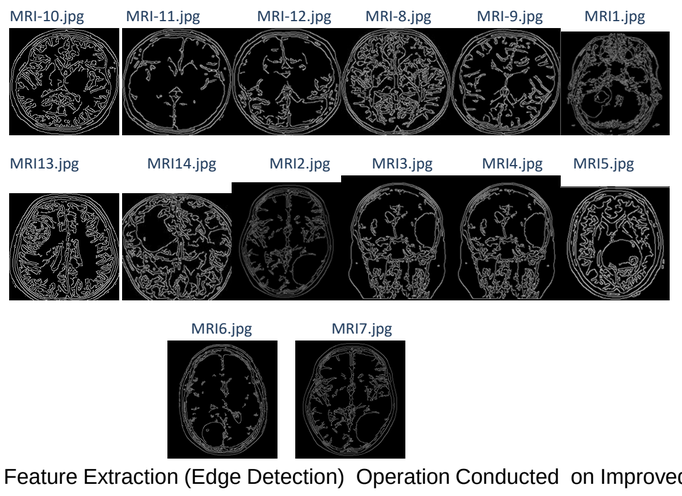
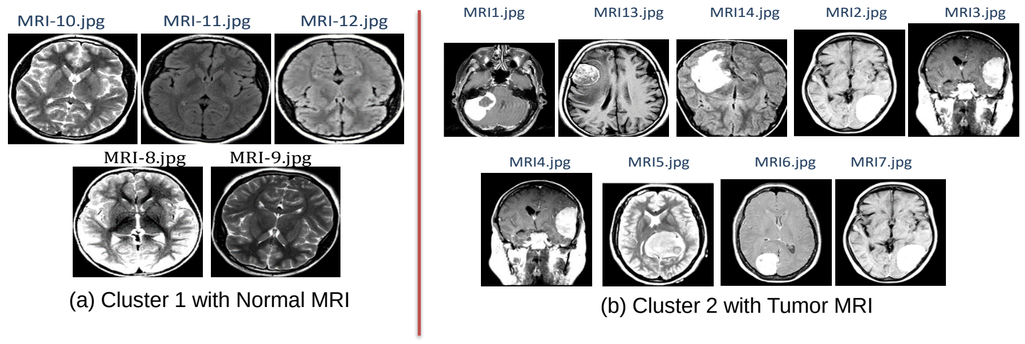


Figure 4: Result of Feature Extraction (Edge Detection) Operation Conducted on Improved MRI Image Set in the Figure 3



(a) Cluster 1 with Normal MRI

(b) Cluster 2 with Tumor MRI

Figure 5: Training Result of Input MRI Image Set in Figure 3

CONCLUSION

The proposed NMICS system is tested over the sample input MRI image set in the Figure 2 in various level according to the system flow and the respective results are presented in the various figures including Figure 3, Figure4, Figure 5 and Figure 6. The experimental results are showing that our NMICS system is simple and well suitable to diagnosis the MRI images.

FUTURE WORK / REFERENCES

[1]Suraj Patil, Dnyaneshwar Kirange, "Ensemble of deep learning models for brain tumor detection", International Conference on Machine Learning and Data Engineering , pp 2468-2479,2023.